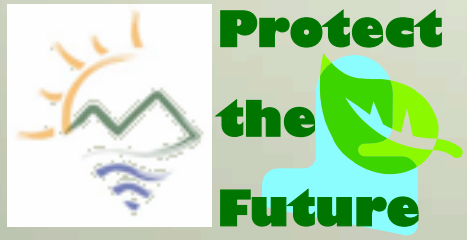

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Nanomaterials:

New Challenges, New Strategies

Jeffrey Wong, Ph.D., Chief Scientist

Department of Toxic Substances Control
California Environmental Protection Agency

Lawrence Berkeley National Lab in Berkeley

July 29th, 2009

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Disclaimer

Opinions presented today are those of the speaker. Policies continue to evolve and therefore what is expressed today **may not** represent the final official position or policy.

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What will California Make?

Economic Profile

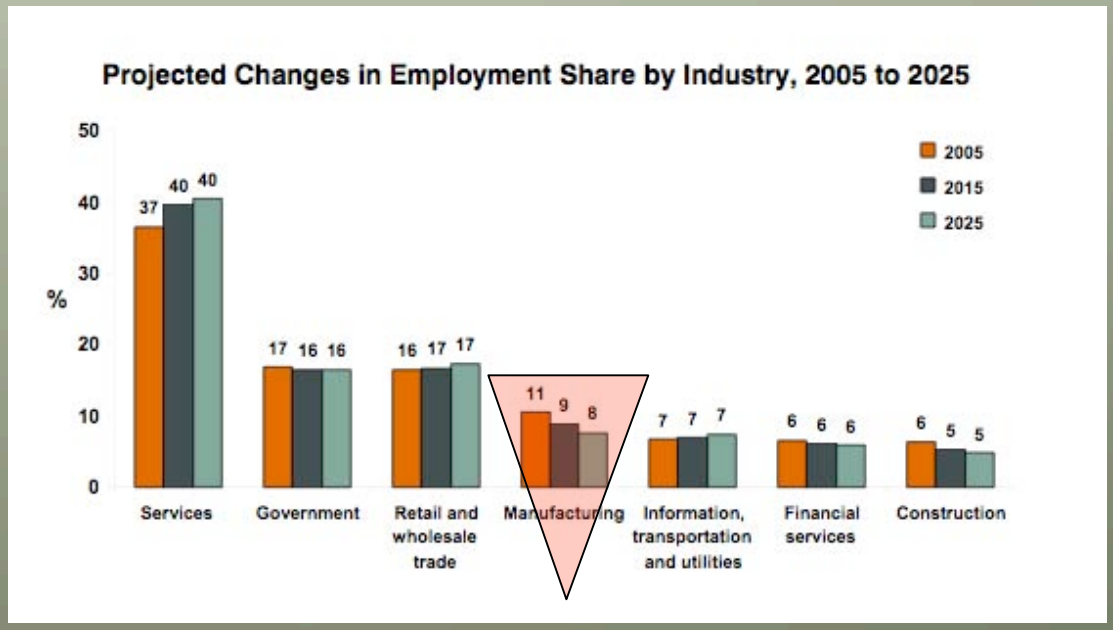
California's main economic sectors and their contribution to GDP are as follows:

Economic Sectors in California, 2005 (in US millions)

Sector		% of State GDP
Services	420,779	25.3
Finance, insurance, and real estate	380,401	22.9
Government	178,431	10.7
Manufacturing	157,148	9.5
Retail trade	113,903	6.9
Information	107,120	6.4
Wholesale trade	92,548	5.6
Construction	76,487	4.6
Transportation and public utilities	62,483	3.8
Agriculture, forestry, and fishing	23,132	1.4
Mining	9,685	0.6
Total	1,622,117	

Source: Bureau of Economic Analysis

California Chamber of Commerce



California's Future Economy, Public Policy Institute, September 2008

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Nanomaterials: California Gold

Margo Johnson,
bp2.blogger.com/.../ s320/Picture+1.png

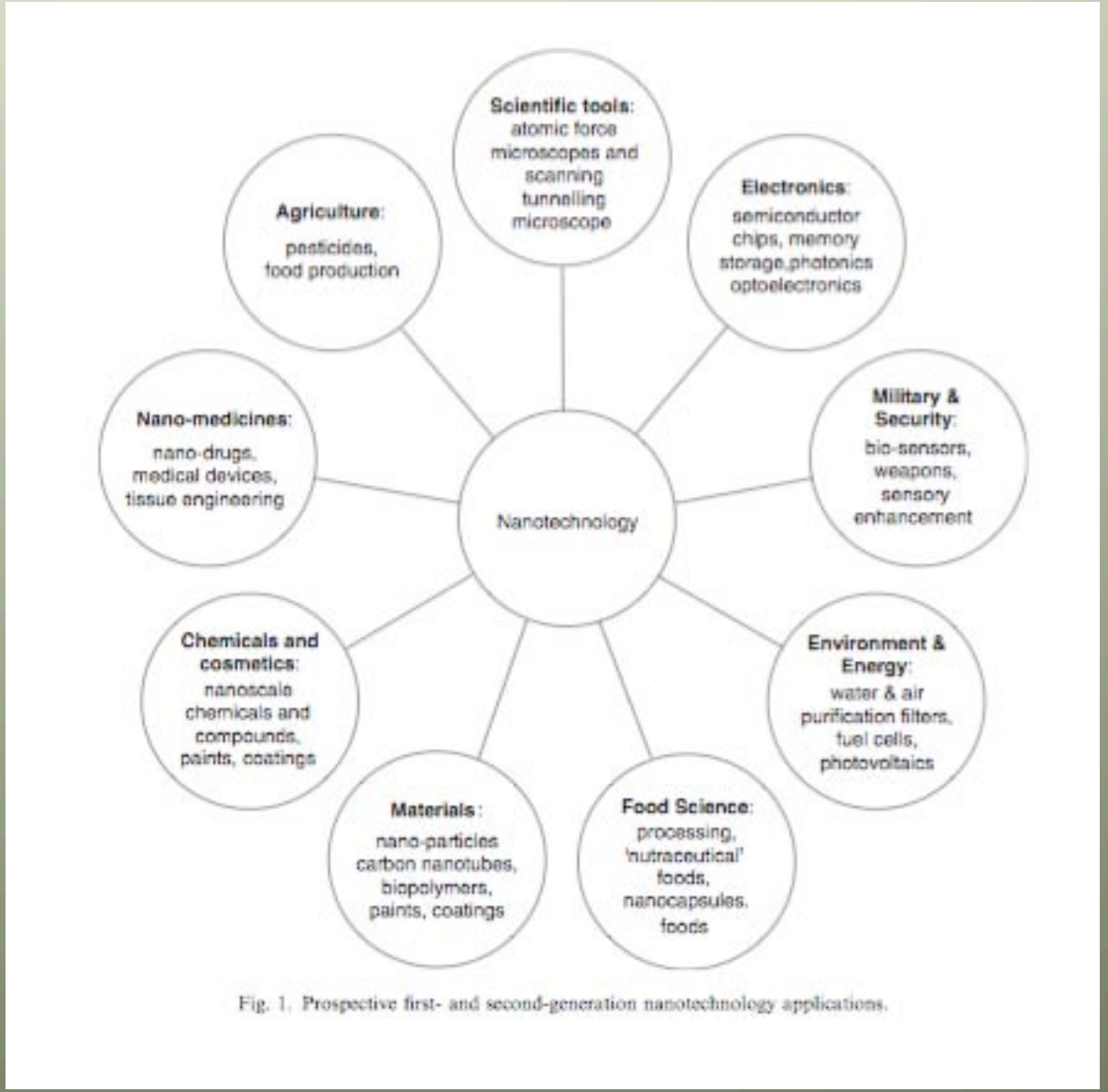

Fig. 1. Prospective first- and second-generation nanotechnology applications.

Nanotechnology: Mapping the wild regulatory frontier,
Diana M. Bowman, Graeme A. Hodge,
www.elsiever.com/local/futures, 2006

What do we see?

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SNUR for CNT effective June 24, 2009

City of Berkeley 2006

Recommendations for a Municipal Health & Safety Policy for Nanomaterials
A Report to the Cambridge City Manager
July 2008

e
ENVIRONMENTAL DEFENSE FUND
finding the ways that work

Hiding a toxic nanomaterial's identity: TSCA's disappearing act
July 14, 2009
Richard Denison, Ph.D.

http://www.etoxics.org/site/PageServer?pagename=svtc_publications

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California
& Nanotechnology

- **Protect public health and the environment.**
  - **Sustain innovation and success by creating trust in the marketplace**
  - **Fill the marketplace with information**
    - **AB 289 – Data Call-in (CNT issued 01.09)**
    - **AB 1879 – Safer Alternatives**
    - **SB 509 – Information Portal**

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Improving Public Health & Environmental Protection

- **Toxics in consumer products.** Mounting evidence shows relationship between chemicals in products & negative impacts
- **Information lacking for businesses and consumers.** Knowledge about chemicals in products & their impacts is limited
- **Existing cradle-to-grave framework is inadequate.** Failed graves
- **Focus on design and process that leads to better protection and products**

http://img.quamut.com/chart/6781/03_consumer_purchase_decision.jpg

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Words of caution…

- "..[T]he properties of nanoparticles can be sufficiently different.. that standard regulatory approaches.. may not be protective of public health and the environment."

Bernard D. Goldstein, M.D.

University of Pittsburgh GRADUATE SCHOOL of PUBLIC HEALTH

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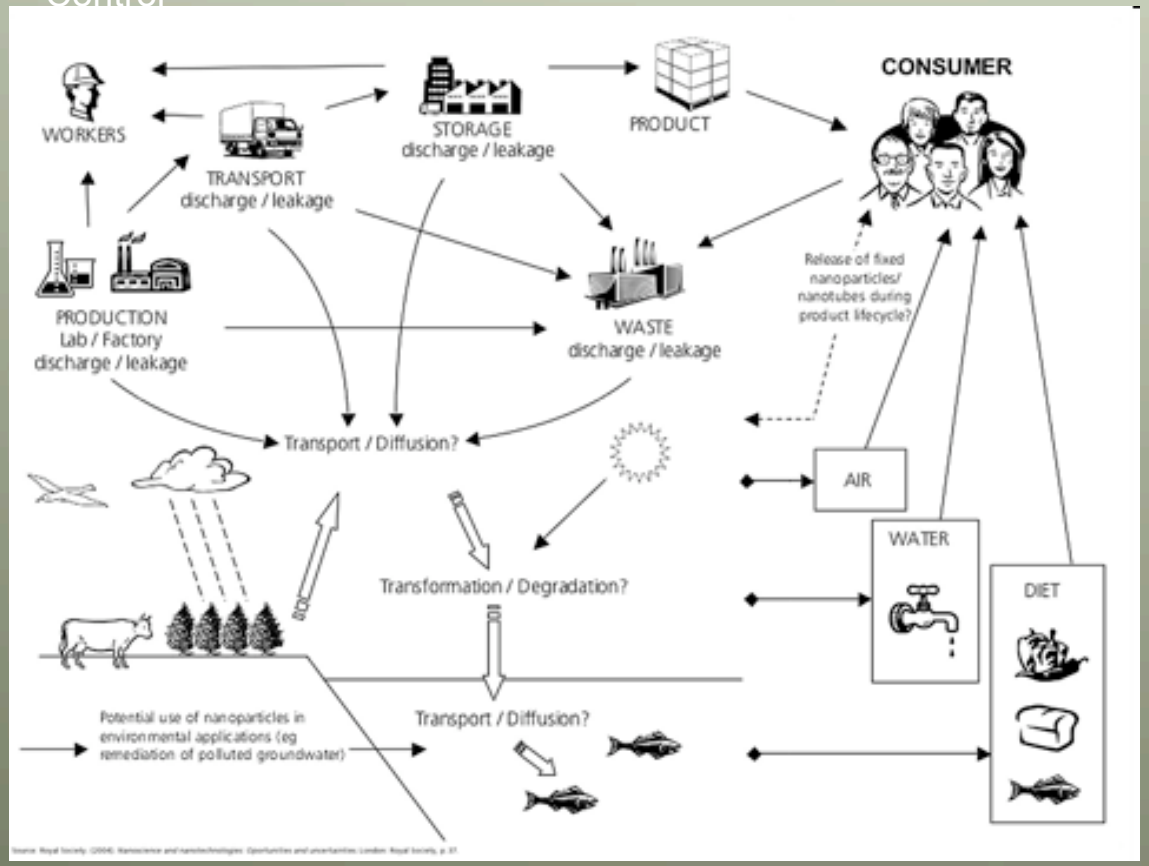
"Danger, Will Robinson!"

"Deadliest of the Species." *Lost in Space* (1965-68)



- Unique properties
- Unsure about hazards that maybe associated with size, shape, chemical/physical properties, etc.
- Unknown exposures
- Lack of standardized analytical and hazard evaluation methodologies…

http://www.clarkson.edu/projects/nanobird/images/health_safety/exposure.png

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California's Initial Approach:

Health & Safety Code
Chapter 699, Section 57019-20
(AB 289, 2006, Assembly Member Wilma Chan)

- Identify California manufacturers
- Research and identify information needs
- Consult with external experts on information needs (universities, industry associations and others)
- Notification on the DTSC and Cal/EPA web sites
- Collaborate with manufacturers
- Manufacturers have up to one year to provide the requested information
- Protect trade secret claims
- Share the information provided

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What is a nanotechnology or nanomaterial ?

Nanomaterials	Solar	Alt. power and energy storage	Water technologies	Biomaterials and biotechnology
• Nanocomposites • Nanocoatings • Nanocatalysts • Nanomaterial applications • Ceramic nanoparticles • Metal nanoparticles • Carbon nanotubes • Fullerenes • Dendrimers • Nanostructured bulk materials • Nanoporous materials • Quantum dots • Nanowires • Nanostructured surfaces • Polymer nanofibers	• Crystalline silicon (mono- and multi-crystalline silicon) • Ribbon silicon • Silicon thin-film (amorphous, microcrystalline, and nanocrystalline) • Solar thermal • Concentrating solar • CIGS/CIS thin films • CdTe thin films • Additional system components (substrates, encapsulants, etc.) • Balance of systems components (trackers, inverters, etc.) • Electrochemical/dye-sensitized (Grätzel) solar cells • Organic thin-film solar cells • Building-integrated photovoltaics (BIPV) • Printable solar cells	• Battery technologies • Battery materials • Super/ ultracapacitor • Printed batteries • Flow batteries • Compressed air energy storage (CAES) • Flywheels • Thermoelectric cooling/heating • Thermoelectric materials • Thermoelectric power generation • Hybrid electric vehicles • Alternative engines • Fuel cell devices • Fuel cell catalysts/MEAs • Fuel cell components • Hydrogen storage devices • Hydrogen storage materials • Uninterruptible power supply (UPS)	• Water purification equipment • Water purification membranes • Water purification filters • Containment technologies • Desalination technologies • Contaminant removal • Water treatment • Water mapping • Water monitoring • Water formation • Wastewater technologies • Stormwater technologies • Industrial water technologies • Sensor technologies	• Targeted delivery , nanoencapsulation and nanoparticulate reformulations • Molecular diagnostics • Biopharmaceuticals and biomanufacturing • Genetic engineering and GMOs • Surfaces/ biointerfaces • Drug-device combinations • Regenerative medicine • RNAi and gene therapy • Synthetic biology • Systems biology • Biopolymers and composites • Biocatalysis and enzymes

luxresearch

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Words of advice…

- "For regulatory regimes: characterization based upon size etc. are not as useful as characterization based upon use."

Bernard D. Goldstein, M.D.

University of Pittsburgh GRADUATE SCHOOL of PUBLIC HEALTH

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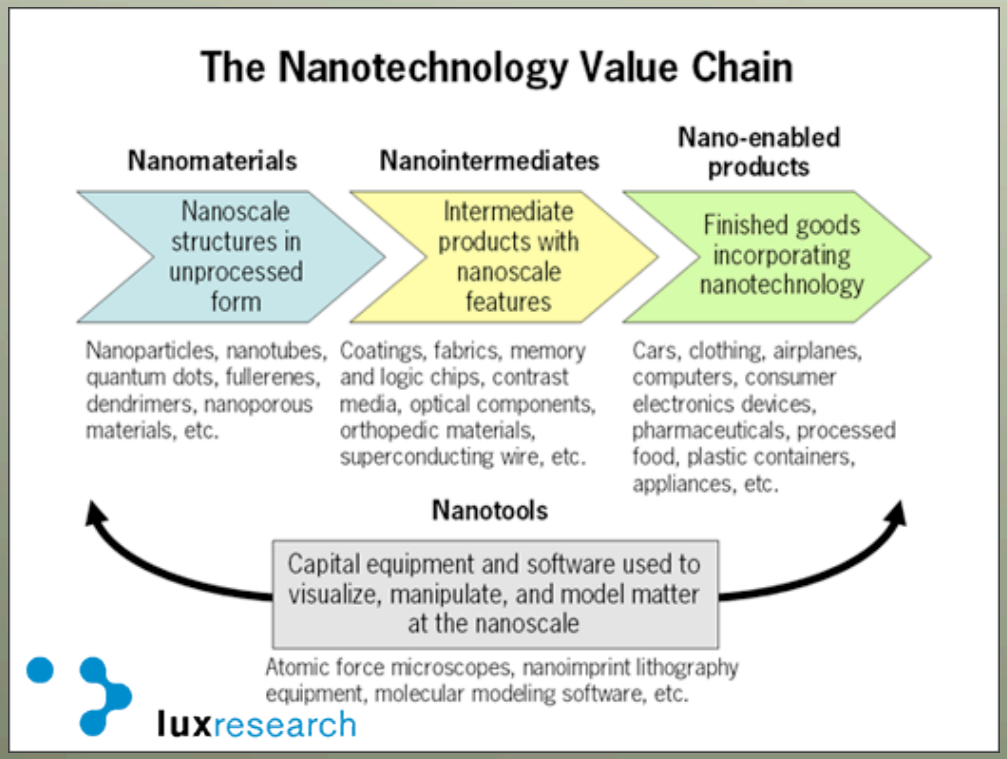
Predicting Potential Exposure through the Value Chain:



- Who makes what and where ?
- Who buys what and what do they do with it ?
- What products involve nanomaterials ?
- What happens at “end-of-life ?”

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Words that question…

- "[Can we] develop expertise to be able to utilize knowledge about physicochemical properties.. to accurately predict biological effects?"

Bernard D. Goldstein, M.D.

University of Pittsburgh GRADUATE SCHOOL of PUBLIC HEALTH

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First we have to find it….

(to determine exposure)

And in that very lab, on that humid July night in 1904, William O. Tompkins performed the first successful synthesis of water, thereby beginning life on Earth.

- Detection in environment ?
- Detection in body ?
- How will measurement be made?
- What isolation methodology will be used?
- How to determine identity/form of chemical ?

http://www.marriedtothesea.com/mtts-archives/mttsarchive-may07.php

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Is there a toxicologist in the house?

Current toxicology and risk assessment capacity has been surpassed?

Regulatory policy paradigm shift ?

Base regulatory decisions on “less than whole animal?

Should business decisions “not to invest” be based upon “less than regulatory decisions?”

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AB 289 CNT Questions: due Jan 2010

- What sampling, detection and measurement methods to detect and measure the presence in the workplace and the environment?

- What methods used to protect workers in the research and manufacturing environment?

- Knowledge about the current and projected presence in the environment that results from manufacturing, distribution, use, and end-of-life disposal?

- Knowledge about the safety in terms of occupational safety, public health and the environment?

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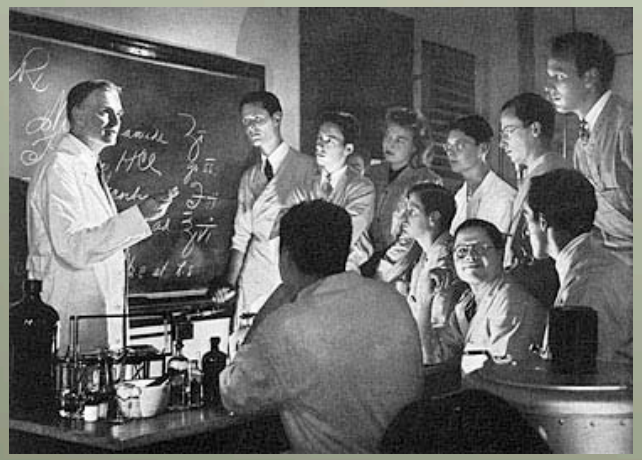
Next Steps under AB 289



- **Expand Call-in**
  - Nanomaterials & chemicals
- **Form Partnerships**
  - Manufacturing & Retail
  - Nanotechnology Sector
  - Universities
  - State Agencies
- **Increase in Authority ?**
  - Based upon CNT experience
  - Incentive
  - Enforcement
  - Integrate with **GCI**

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Words about “pre-caution”

- “[There needs to be a] significant investment in good science to make decisions based upon knowledge rather than the uncertain conditions that invoke the use of the precautionary principle.”

Bernard D. Goldstein, M.D.

University of Pittsburgh GRADUATE SCHOOL of PUBLIC HEALTH

Green Chemistry Initiative

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Assistance Up Market

Expand Pollution Prevention

Market Incentives

Move toward a Cradle-to-Cradle Economy

21st Century Workforce

Building Capacity

Green Chemistry Initiative

Find Safer Alternatives

Accelerate the Quest For Safer Products (AB 1879)

Online Product Ingredient Network

Product Content

Online Toxics Clearing House (SB 509)

Information for the marketplace

Governor Schwarzenegger

Assembly Member Feuer, Senator Simitian

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Choosing Safer Alternatives AB 1879

COCs & priorities

- Identify and prioritize products/chemicals
- Identify & prioritize end uses

Alternatives Assessment w/LCA

- Identify, evaluate and compare alternatives
- Select and review preferred alternative

Regulatory Responses

- Implement preferred alternative

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At the leading edge…..

Your time and attention has been appreciated !